

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (currently amended): A substrate for mounting an IC chip comprising:
an insulating substrate having a first surface and a second surface on an opposite side of the first surface;
a first built-up structure formed on the first surface of the insulating substrate and comprising a conductor circuit and an interlaminar insulating layer;
a second built-up structure formed on the second surface of the insulating substrate and comprising a conductor circuit and an interlaminar insulating layer;
a solder resist layer formed as an outermost layer over the first built-up structure;
an optical element mounted over the solder resist layer;
a resin layer formed between the solder resist layer and the optical element; and
an optical path for transmitting optical signal to or from the optical element and penetrating through the insulating substrate, first built-up structure, second built-up structure and solder resist layer .

Claims 2-5 (canceled)

Claim 6 (currently amended): The substrate for mounting an IC chip according to ~~any of Claims 1 to 5~~ Claim 1, wherein the optical element is mounted on the solder resist layer.

Claim 7 (previously presented): The substrate for mounting an IC chip according to Claim 6, wherein said optical element is at least one of a light receiving element and a light emitting element.

Claim 8 (previously presented): The substrate for mounting an IC chip according to Claim 1, further comprising an electronic component mounted on a surface of one of the solder resist layer.

Claim 9 (previously presented): The substrate for mounting an IC chip according to Claim 1, further comprising a micro lens disposed on an end portion of the optical path for transmitting optical signal.

Claim 10 (previously presented): The substrate for mounting an IC chip according to Claim 1, wherein the optical path for transmitting optical signal has a cross-sectional diameter which is 100 to 500 μm .

Claim 11 (previously presented): The substrate for mounting an IC chip according to Claim 1, further comprising a plated-through hole connecting the conductor circuit of the first built-up structure and the conductor circuit of the second built-up structure through the insulating substrate and a via-hole connecting the conductor circuit in the first built-up structure and another conductor circuit in the first-built-up structure through the interlaminar insulating layer in the first built-up structure.

Claim 12 (withdrawn): A manufacturing method of a substrate for mounting an IC chip, comprising:

(a) a multilayered circuit board manufacturing step of serially building up a conductor circuit and an interlaminar insulating layer on both faces of a substrate in an alternate fashion and in repetition to provide a multilayered circuit board;

(b) a through hole formation step of forming a through hole in said multilayered circuit board; and

(c) a solder resist layer formation step of forming a solder resist layer having an opening communicating with the through hole formed in said step (b).

Claim 13 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to Claim 12, comprising:

a roughened face formation step of forming a roughened face on a wall face of the through hole formed in said step (b).

Claim 14 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to Claim 12 or 13, comprising:

a conductor layer formation step of forming a conductor layer on a wall face of the through hole formed in said step (b).

Claim 15 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any one of Claims 12 to 14, comprising:

a resin composition filling step of filling an uncured resin composition into the through hole formed in said step (b).

Claim 16 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any one of Claims 12 to 15, comprising:

a micro lens disposition step of disposing a micro lens on an end portion of the opening formed in said step (c).

Claim 17 (withdrawn): A device for optical communication comprising a substrate for mounting an IC chip and a multilayered printed circuit board, wherein an optical path for transmitting optical signal which penetrates said substrate for mounting an IC chip is formed in the substrate for mounting an IC chip.

Claim 18 (withdrawn): A device for optical communication comprising a substrate for mounting an IC chip and a multilayered printed circuit board, wherein said multilayered printed circuit board includes a substrate and a conductor circuit, and an optical path for transmitting optical signal which penetrates at least the substrate is formed in said multilayered printed circuit board.

Claim 19 (withdrawn): A device for optical communication comprising a substrate for mounting an IC chip and a multilayered printed circuit board, wherein an optical path for transmitting optical signal which penetrates said substrate for mounting an IC chip is formed in the substrate for mounting an IC chip, said multilayered printed circuit board includes a

substrate and a conductor circuit, and an optical path for transmitting optical signal which penetrates at least the substrate is formed in said multilayered printed circuit board.

Claim 20 (withdrawn): The device for optical communication according to any of claims 17 to 19, wherein said optical path for transmitting optical signal comprises a vacancy.

Claim 21 (withdrawn): The device for optical communication according to any of claims 17 to 19, wherein said optical path for transmitting optical signal comprises a resin composition and a vacancy.

Claim 22 (withdrawn): The device for optical communication according to any of claims 17 to 19, wherein said optical path for transmitting optical signal comprises a vacancy and a conductor layer around the vacancy.

Claim 23 (withdrawn): The device for optical communication according to any of claims 17 to 19, wherein said optical path for transmitting optical signal comprises a resin composition, a vacancy, and a conductor layer around the resin composition and the vacancy.

Claim 24 (withdrawn): The device for optical communication according to any of claims 17 to 23, wherein a micro lens is disposed on an end portion of said optical path for transmitting optical signal.

Claim 25 (withdrawn): The device for optical communication according to any of claims 17 to 24, wherein a cross-sectional diameter of said optical path for transmitting optical signal is 100 to 500 μm .

Claim 26 (withdrawn): The device for optical communication according to any of claims 17 to 25, wherein an optical element is mounted on said substrate for mounting an IC chip, and a position at which said optical element is mounted is on a surface of the substrate for mounting an IC chip.

Claim 27 (withdrawn): The device for optical communication according to claim 26, wherein said optical element is a light receiving element and/or a light emitting element.

Claim 28 (withdrawn): The device for optical communication according to any of claims 17 to 27, wherein said substrate for mounting an IC chip includes conductor circuits, interlaminar insulating layers, and a via-hole connecting the conductor circuits across said interlaminar insulating layers.

Claim 29 (withdrawn): A device for optical communication comprising:
a substrate for mounting an IC chip on which at least an optical element is mounted;
and
a multilayered printed circuit board on which at least an optical waveguide is formed,
the device for optical communication being constituted to be able to transmit optical signal between said optical waveguide and said optical element,
wherein a sealing resin layer is formed between said substrate for mounting an IC chip and said multilayered printed circuit board.

Claim 30 (withdrawn): The device for optical communication according to Claim 29, wherein said sealing resin layer has a transmissivity of 70 %/mm or more for communication wavelength light.

Claim 31 (withdrawn): The device for optical communication according to Claim 29 or 30, wherein said sealing resin layer contains particles.

Claim 32 (withdrawn): The device for optical communication according to any of claims 29 to 31, wherein said optical element is a light receiving element and/or a light emitting element.

Claim 33 (withdrawn): A manufacturing method of a device for optical communication, wherein after separately manufacturing a substrate for mounting an IC chip on which at least an optical element is mounted, and a multilayered printed circuit board on which at least an optical waveguide is formed, said substrate for mounting an IC chip and said multilayered printed circuit board are disposed at and fixed to such respective positions

as to be able to transmit optical signal between the optical element of said substrate for mounting an IC chip and the optical waveguide of said multilayered printed circuit board, and further, a resin composition for sealing is caused to flow between said substrate for mounting an IC chip and said multilayered printed circuit board and then a curing treatment is conducted, thereby forming a sealing resin layer.

Claim 34 (withdrawn): A device for optical communication comprising:

a substrate for mounting an IC chip having at least an area for mounting an optical element in which an optical element is mounted and a resin filled layer for an optical path is formed; and

a multilayered printed circuit board at which at least an optical waveguide is formed, wherein said device for optical communication is constituted such that optical signal can be transmitted between said optical waveguide and said optical element through said resin filled layer for an optical path.

Claim 35 (withdrawn): The device for optical communication according to claim 34, wherein a sealing resin layer is formed between said substrate for mounting an IC chip and said multilayered printed circuit board.

Claim 36 (withdrawn): The device for optical communication according to claim 35, wherein said sealing resin layer has a transmissivity of 70 %/mm or more for communication wavelength light.

Claim 37 (withdrawn): The device for optical communication according to claim 35 or 36, wherein said sealing resin layer contains particles.

Claim 38 (withdrawn): The device for optical communication according to any of claims 34 to 37, wherein at least one micro lens is disposed on a face of said resin filled layer for an optical path, said face confronting the multilayered printed circuit board.

Claim 39 (withdrawn): The device for optical communication according to any of claims 35 to 37, wherein at least one micro lens is disposed on a face of said resin filled layer for an optical path, said face confronting the multilayered printed circuit board, and said micro lens has a refractive index higher than that of said sealing resin layer.

Claim 40 (withdrawn): The device for optical communication according to any of claims 34 to 39, wherein said optical element is a light receiving element and/or a light emitting element.

Claim 41 (withdrawn): A manufacturing method of a device for optical communication, wherein after separately manufacturing: a substrate for mounting an IC chip having at least an area for mounting an optical element in which an optical element is mounted and a resin filled layer for an optical path is formed; and a multilayered printed circuit board to which at least an optical waveguide is formed, said substrate for mounting an IC chip and said multilayered printed circuit board are disposed at and fixed to such respective positions as to be able to transmit optical signal between the optical element of said substrate for mounting an IC chip and the optical waveguide of said multilayered printed circuit board, and further, a resin composition for sealing is made to flow between said substrate for mounting an IC chip and said multilayered printed circuit board and then, a curing treatment is conducted, thereby forming a sealing resin layer.

Claim 42 (withdrawn): A device for optical communication comprising:
a substrate for mounting an IC chip at which an optical path for transmitting optical signal is formed, and on one face of said substrate, an optical element is mounted; and
a multilayered printed circuit board at which at least an optical waveguide is formed,
wherein said device for optical communication is constituted such that optical signal can be transmitted between said optical waveguide and said optical element through said optical path for transmitting optical signal.

Claim 43 (withdrawn): The device for optical communication according to claim 42, wherein a sealing resin layer is formed between said substrate for mounting an IC chip and said multilayered printed circuit board.

Claim 44 (withdrawn): The device for optical communication according to claim 43, wherein said sealing resin layer has a transmissivity of 70 %/mm or more for communication wavelength light.

Claim 45 (withdrawn): The device for optical communication according to claim 43 or 44, wherein said sealing resin layer contains particles.

Claim 46 (withdrawn): The device for optical communication according to any of claims 42 to 45, wherein a micro lens is disposed on an end portion on at least a multilayered printed circuit board side of said optical path for transmitting optical signal.

Claim 47 (withdrawn): The device for optical communication according to any of claims 43 to 45, wherein a micro lens is disposed on an end portion on at least a multilayered printed circuit board side of said optical path for transmitting optical signal, and said micro lens has a refractive index higher than that of said sealing resin layer.

Claim 48 (withdrawn): The device for optical communication according to any of claims 42 to 47, wherein said optical element is a light receiving element and/or a light emitting element.

Claim 49 (withdrawn): The device for optical communication according to any of claims 42 to 48, wherein a resin layer for an optical path is formed inside said optical path for transmitting optical signal.

Claim 50 (withdrawn): A manufacturing method of a device for optical communication, wherein after separately manufacturing: a substrate for mounting an IC chip to which an optical path for transmitting optical signal is formed, and to one face of said substrate an optical element is mounted; and a multilayered printed circuit board to which at

least an optical waveguide is formed, said substrate for mounting an IC chip and said multilayered printed circuit board are disposed at and fixed to such respective positions as to be able to transmit optical signal between the optical element of the substrate for mounting an IC chip and the optical waveguide of the multilayered printed circuit board, and further, a resin composition for sealing is made to flow between said substrate for mounting an IC chip and said multilayered printed circuit board and then, a curing treatment is conducted, thereby forming a sealing resin layer.

Claim 51 (withdrawn): A substrate for mounting an IC chip comprising:

a substrate, as serially built up on both faces thereof, a conductor circuit and an interlaminar insulating layer in an alternate fashion and in repetition;

a solder resist layer formed as an outermost layer; and

an optical element mounted thereto,

wherein an optical waveguide is formed inside said substrate for mounting an IC chip, and an optical path for transmitting optical signal which connects said optical element to said optical waveguide is formed.

Claim 52 (withdrawn): The substrate for mounting an IC chip according to claim 51, wherein said optical waveguide is an organic optical waveguide.

Claim 53 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a vacancy.

Claim 54 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a resin composition and a vacancy.

Claim 55 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a resin composition.

Claim 56 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a vacancy and a conductor layer around the vacancy.

Claim 57 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a resin composition, a vacancy, and a conductor layer around the resin composition and the vacancy.

Claim 58 (withdrawn): The substrate for mounting an IC chip according to claim 51 or 52, wherein said optical path for transmitting optical signal comprises a resin composition and a conductor layer around the resin composition.

Claim 59 (withdrawn): The substrate for mounting an IC chip according to any of claims 51 to 58, wherein a position at which said optical element is mounted is on a surface of the substrate for mounting an IC chip.

Claim 60 (withdrawn): The substrate for mounting an IC chip according to claim 59, wherein said optical element is a light receiving element and/or a light emitting element.

Claim 61 (withdrawn): The substrate for mounting an IC chip according to any of claims 51 to 60, wherein an electronic component is mounted on a surface of said substrate for mounting an IC chip.

Claim 62 (withdrawn): The substrate for mounting an IC chip according to any of claims 51 to 61, wherein a micro lens is formed on an end portion of said optical path for transmitting optical signal or in said optical path for transmitting optical signal.

Claim 63 (withdrawn): The substrate for mounting an IC chip according to any of claims 51 to 62, wherein a cross-sectional diameter of said optical path for transmitting optical signal is 100 to 500 μm .

Claim 64 (withdrawn): The substrate for mounting an IC chip according to any of claims 51 to 63, wherein the conductor circuits across said substrate are connected to each

other through a plated-through hole, and the conductor circuits across said interlaminar insulating layers are connected to each other through a via-hole.

Claim 65 (withdrawn): A manufacturing method of a substrate for mounting an IC chip, wherein a substrate, an optical waveguide, and a lamination manufactured through at least the following steps (a) to (c) are built up in this order: (a) a conductor circuit lamination formation step of serially building up conductor circuits and interlaminar insulating layers on a base material layer in an alternate fashion and in repetition to provide a conductor circuit lamination; (b) an opening formation step of forming an opening which becomes an optical path for transmitting optical signal in said conductor circuit lamination; and (c) a solder resist layer formation step of forming a solder resist layer having an opening communicating with the opening formed in said step (b), on one face of said conductor circuit lamination.

Claim 66 (withdrawn): A manufacturing method of a substrate for mounting an IC chip, comprising:

(a) an optical waveguide formation step of forming an optical waveguide on a substrate on which conductor circuits are formed;

(b) a multilayered circuit board manufacturing step of serially building up interlaminar insulating layers and conductor circuits on the substrate, on which said optical waveguide is formed, in an alternate fashion and in repetition to provide a multilayered circuit board;

(c) an opening formation step of forming an opening which becomes an optical path for transmitting optical signal in said multilayered circuit board; and

(d) a solder resist layer formation step of forming a solder resist layer having an opening communicating with the opening formed in said step (c) on one face of said multilayered circuit board.

Claim 67 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to claim 65 or 66, comprising:

a roughened face formation step of forming a roughened face on a wall face of the opening which becomes said optical path for transmitting optical signal.

Claim 68 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any of claims 65 to 67, comprising:

a conductor layer formation step of forming a conductor layer on a wall face of the opening which becomes said optical path for transmitting optical signal.

Claim 69 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any of claims 65 to 68, comprising:

a resin composition filling step of filling an uncured resin composition into the opening which becomes said optical path for transmitting optical signal.

Claim 70 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any of claims 65 to 69, comprising:

a micro lens formation step of forming a micro lens on an end portion of the opening which becomes said optical path for transmitting optical signal.

Claim 71 (withdrawn): The manufacturing method of a substrate for mounting an IC chip according to any of claims 65 to 69, comprising:

a micro lens formation step of forming a micro lens in the opening which becomes said optical path for transmitting optical signal.